Remarks:

Claims 1-21, 30-37, and 45 remain for consideration in this application. Claims 22-29, 38-44, and 46-60 were canceled. In view of the foregoing amendments and remarks hereunder, the rejections of the last office action are respectfully traversed.

Turning now to the office action, the Examiner requested that claims 8 and 34 be amended by deleting specific occurrence of the word "the" in order to improve the clarity of these claims. Applicants have so amended claims 8 and 34.

The Examiner objected to claims 8, 9, 18, 19, and 34 as failing to further limit the subject matter of a previous claim. Specifically, each of the forgoing claims recites zinc and the Examiner submits that zinc is not included by the independent claims recitation of "Groups IIA, IIIA, IVA, transition metals, and lanthanide series of the CAS Periodic Table." Applicants respectfully traverse this rejection as zinc is a transition metal. Applicants have attached a copy of the entry for zinc from EnvironmentalChemistry.com which clearly states that zinc is a member of the transition metal series. Therefore, Applicants request that the objection under 37 C.F.R. 1.75(c) be withdrawn.

The Examiner rejected claims 1, 12, and 30 under 35 U.S.C. 112, first paragraph, on two separate bases. First, the Examiner considered "at a nano-" to be new matter. Applicants have removed this phrase from the claims thereby rendering this rejection moot. Second, the Examiner considered "CAS" to be new matter as the list of individual metals includes zinc which is not a member of Groups IIA, IIIA, or IVA of the CAS Periodic Table. As noted above, zinc is a member of the transition metal series. Applicants restate their argument from the previous amendment dated October 25, 2004, that the Periodic Table being referred to in the specification is the CAS Periodic

Table. For example, the specification notes that aluminum is a preferred metal ion component of the hydroxides and oxides. Aluminum is a member of Group IIIA of the CAS Periodic Table and not of the IUPAC Table. In addition, the CAS table has been employed as the primary Periodic Table in the United States for decades. Therefore, one of skill in the art would easily be able to deduce from the specification that the groups referred to were groups of the CAS Periodic Table. Applicants request withdrawal of this rejection.

The Examiner rejected claims 1, 12, and 45 under 35 U.S.C. 112, second paragraph, as being indefinite. With respect to claims 1 and 12, as stated above, Applicants have removed the phrase "on a nano-". The phrase "intimately intermingled" now stands alone. As noted in the previous amendment, there are at least three instances where the USPTO has allowed claims containing this phrase. Applicants have amended claim 45 to recite that the groups referred to therein are from the CAS Periodic Table. For the reasons stated above, this amendment does not constitute the introduction of new matter. Applicants request that this rejection be withdrawn.

The Examiner rejected claims 1-21 and 45 under 35 U.S.C. 103(a) as being unpatentable over Koper '488 or Klabunde '294. Independent claims 1, 12, 30, and 45 have been amended to recite that the solid composition comprises different materials that are *co-solidified* with one of the different nanocrystalline materials forming a *matrix* in which the crystallites of the at least one other different nanocrystalline materials are dispersed. Support for this amendment may be found in the specification on page 4, lines 27-30, and page 5, lines 5-9. The Examiner relies upon essentially the same disclosure in each reference that lists several metal oxide compounds and "mixtures thereof" in order to reject the present claims. The Examiner states that "the different metal oxide nanoscale

powders can be in a mixture thereof which suggest such intimate intermingling on a nano-level because the metal oxide powders each have an average crystallite size of about 3-4 nm." (Page 6, of the Office Action dated 2/9/05)

At no time do Koper '488 or Klabunde '294 teach or suggest the presently claimed *co-solidified* structure comprising on nanocrystalline metal oxide or hydroxide dispersed within a *matrix* of another nanocrystalline metal oxide or hydroxide. At best, Koper and Klabunde may be interpreted as describing mixtures of separately-formed nanocrystalline powders. However such powder mixtures are readily distinguishable from the presently claimed materials. There is no discussion of or enablement for the co-solidification of different metal oxide or hydroxide materials with one of the materials forming a matrix in which at least one other material is dispersed. Furthermore, the coated metal oxide particles of Koper can hardly be characterized as "co-solidified" or one metal oxide dispersed in a matrix of another metal oxide. Koper is very clear that the first metal oxide is fabricated as a particulate material and then the second metal oxide material is applied onto the surface of the first metal oxide as an extremely thin layer. Thus there is no co-solidification and no dispersion of metal oxide particles within a matrix of another metal oxide. Applicants submit that independent claims 1, 12, 30, and 45 are allowable over these two references.

The Examiner also rejected claims 1-21, 30-37, and 45 under 35 U.S.C. 103(a) as being unpatentable over Koper '519. Essentially the same disclosure is being relied upon as with the Koper '488 reference discussed above. Therefore, the same shortcomings exist with Koper '519 in that Koper does not disclose or in any way enable formation of co-solidified nanocrystalline

materials with one material forming a matrix in which the crystallites of another material are dispersed. Applicants respectfully request that this rejection be withdrawn.

A petition for a one-month extension of time and the required fee are enclosed herewith along with a Request for Continued Examination.

Any additional fee which is due in connection with this amendment should be applied against our Deposit Account No. 19-0522.

In view of the foregoing, a Notice of Allowance appears to be in order and such is courteously solicited.

Respectfully submitted,

By _____

Gregory J. Skoch, Reg. No. 48,267
HOVEY WILLIAMS LLP
2405 Grand Boulevard, Suite 400
Kansas City, Missouri 64108
816/474-9050

ATTORNEYS FOR APPLICANT(S)

EnvironmentalChemistry.com

Environmental, Chemistry & Hazardous Materials News, Information & Resources

Periodic Table of Elements

Element Zinc - Zn

Comprehensive data on the chemical element Zinc is provided on this page; including scores of properties, element names in many languages, most known nuclides of Zinc. For many elements information on common compounds of is now provided as well. In addition technical terms are linked to their definitions and the menu contains links to related articles that are a great aid in one studies. Using the "Periodic Table of Elements Quick Navigation" graphic at the bottom of the sidebar menu, one can quickly jump from chemical element to chemical element.

Zinc Menu

Overview of Zinc

- Atomic Number: 30
- Group: 12
- Period: 4
- Series: Transition Metals

Zinc's Name in Other Languages

- **Latin:** Zincum
- **Czech:** Zinek
- **Croatian:** Cink
- **French:** Zinc
- **German:** Zink - r
- **Italian:** Zinco
- **Norwegian:** Sink

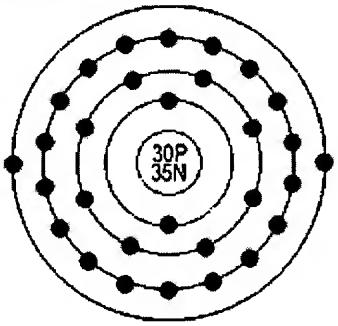
- **Portuguese:** Zinco
- **Russian:** Цинк
- **Spanish:** Zinc
- **Swedish:** Zink

Atomic Structure of Zinc

- **Atomic Radius:** 1.53Å
- **Atomic Volume:** 9.2cm³/mol
- **Covalent Radius:** 1.25Å
- **Cross Section:** 1.1barns ±0.04
- **Crystal Structure:** Hexagonal

- **Electron Configuration:**
  $1s^2\ 2s^2p^6\ 3s^2p^6d^{10}\ 4s^2$
- **Electrons per Energy Level:** 2,8,18,2

Shell Model



- **Ionic Radius:** 0.74Å
- **Filling Orbital:** $3d^{10}$
- **Number of Electrons (with no charge):** 30
- **Number of Neutrons (most common/stable nuclide):** 35
- **Number of Protons:** 30
- **Oxidation States:** 2
- **Valance Electrons:** $4s^2$

Electron Dot Model

Chemical Properties of Zinc

- **Electrochemical Equivalent:** 1.22g/amp-hr
- **Electron Work Function:** 4.33eV
- **Electronegativity (Pauling):** 1.65
- **Heat of Fusion:** 7.322kJ/mol

- **Incompatiblities:**
- **Ionization Potential**
  First: 9.394
  Second: 17.964
  Third: 39.722
- **Valance Electron Potential (-eV):** 38.9

Physical Properties of Zinc

Note: temperature and pressure sensitive calculations are based on normal temperature and pressure (20°C @ 1atm).

- **Atomic Mass Average:** 65.39
- **Boiling Point:** 1180K 907°C 1665°F
- **Coefficient of lineal thermal expansion:**
  0.0000397cm/cm/°C (0°C)
- **Conductivity**
  Electrical: 0.166 10^6/cm Ω
  Thermal: 1.16 W/cmK
- **Density:** 7.13g/cc @ 300K
- **Description:**
  Hard, brittle, shiny bluish-white transition metal.
- **Elastic Modulus:**
  Bulk: 70/GPa
  Rigidity: 43/GPa
  Youngs: 108/GPa
- **Enthalpy of Atomization:** 129.7 kJ/mole @ 25°C
- **Enthalpy of Fusion:** 7.32 kJ/mole
- **Enthalpy of Vaporization:** 115.5 kJ/mole
- **Flammablity Class:**
- **Freezing Point:** *see melting point*
- **Hardness Scale**
  Brinell: 412 MN m^{-2}
  Mohs: 2.5
- **Heat of Vaporization:** 115.3kJ/mol
- **Melting Point:** 692.73K 419.73°C 787.51°F
- **Molar Volume:** 9.16 cm^3/mole
- **Optical Reflectivity:** 80%
- **Optical Refractive Index:** 1.00205
- **Specific Heat:** 0.39J/gK
- **Vapor Pressure** = 19.2Pa@419.73°C
- **Pysical State (at 20°C & 1atm):** Solid

Regulatory / Health

- **CAS Number**: 7440-66-6
- **OSHA Permissible Exposure Limit (PEL)**
  No limits set by OSHA

- **OSHA PEL Vacated 1989**
  No limits set by OSHA
- **NIOSH Recommended Exposure Limit (REL)**
  No limits set by NIOSH

Who / Where / When / How

- **Discoverer:** Andreas Marggraf
- **Discovery Location:** Germany
- **Discovery Year:** 1746
- **Name Origin:**
  German: zin (German for tin).
- **Sources:**
  Found in the minerals zinc blende (sphalerite) (ZnS), calamine, franklinite, smithsonite ($ZnCO_3$), willemite, and zincite (ZnO).
- **Uses:**
  Used to coat other metals (galvanizing) to protect them from rusting. Used in alloys such as brass, bronze, nickel. Also in solder, cosmetics and pigments.
- **Additional Notes:**

Zinc Menu

- **Zinc Page One**
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  - Zinc's Name in Other Languages
  - Atomic Structure of Zinc
  - Chemical Properties of Zinc
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- **Zinc Page Two**
  - Nuclides / Isotopes
  - Potential Parent Nuclides
- **Zinc Page Three**
  - Common Chemical Compounds of Zinc

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```
<a href="http://EnvironmentalChemistry.com/yogi/periodic/Zn.html">Periodic Table of Elements: Zinc - Zn (EnvironmentalChemistry.com)</a> - Comprehensive information for the element Zinc - Zn is provided by this page including scores of properties, element names in many languages, most known nuclides and technical terms are linked to their definitions.
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We greatly appreciate every link provided to our pages.